



GT40PI120C7H

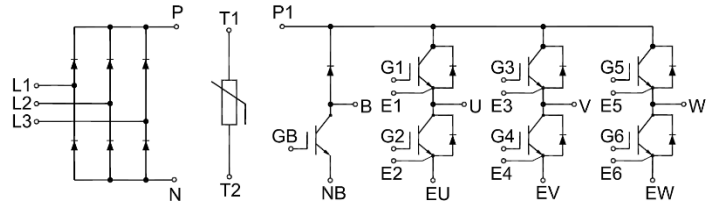
IGBT Module

Preliminary Data

Features:

- Trench & Field Stop IGBT
- Short Circuit Rated $>10\mu\text{s}$
- Low Saturation Voltage
- Low Switching Loss
- 100% RBSOA Tested($2\times I_c$)
- Low Stray Inductance
- Lead Free, Compliant with RoHS Requirement

Circuit Diagram



Applications:

- Industrial Inverters
- Industrial Drivers

IGBT, Inverter

Maximum Rated Values ($T_c=25^\circ\text{C}$ unless otherwise specified)

V_{CES}	Collector-Emitter Blocking Voltage	$T_J=25^\circ\text{C}$	1200	V
V_{GES}	Gate-Emitter Voltage		± 20	V
I_c	Continuous Collector Current	$T_c=100^\circ\text{C}$	40	A
		$T_c=25^\circ\text{C}$	80	A
I_{CM}	Peak Collector Current Repetitive	$t_p=1\text{ms}$	80	A
P_D	Maximum Power Dissipation (IGBT)	$T_c=25^\circ\text{C}$ $T_{Jmax}=175^\circ\text{C}$	288	W



Electrical Characteristics of IGBT ($T_C=25^{\circ}\text{C}$ unless otherwise specified)

Static Characteristics

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=1.5\text{mA}$, $V_{CE}=V_{GE}$, $T_J=25^{\circ}\text{C}$	5.0	5.7	6.5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C=40\text{A}$, $V_{GE}=15\text{V}$	$T_J=25^{\circ}\text{C}$	1.90	2.30	V
			$T_J=125^{\circ}\text{C}$	2.40		
			$T_J=150^{\circ}\text{C}$	2.50		
I_{CES}	Collector-Emitter Leakage Current	$V_{GE}=0\text{V}$, $V_{CE}=V_{CES}$, $T_J=25^{\circ}\text{C}$			1	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=20\text{V}$, $V_{CE}=0\text{V}$, $T_J=25^{\circ}\text{C}$			200	nA
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}$, $V_{GE}=0\text{V}$, $f=100\text{kHz}$, $T_J=25^{\circ}\text{C}$		2.19		nF
C_{oes}	Output Capacitance			0.19		
C_{res}	Reverse Transfer Capacitance			0.04		

Switching Characteristics

$t_{d(on)}$	Turn-on Delay Time	$V_{CC}=600V, I_C=40A,$ $R_{Gon}=36\Omega, V_{GE}=\pm 15V,$ Inductive Load	$T_J=25^{\circ}C$		114		ns
			$T_J=125^{\circ}C$		126		
			$T_J=150^{\circ}C$		130		
t_r	Rise Time		$T_J=25^{\circ}C$		88		ns
			$T_J=125^{\circ}C$		96		
			$T_J=150^{\circ}C$		102		
$t_{d(off)}$	Turn-off Delay Time		$T_J=25^{\circ}C$		338		ns
			$T_J=125^{\circ}C$		362		
			$T_J=150^{\circ}C$		364		
t_f	Fall Time	$T_J=25^{\circ}C$		90		ns	
		$T_J=125^{\circ}C$		110			
		$T_J=150^{\circ}C$		114			
E_{on}	Turn-on Switching Loss	$V_{CC}=600V, I_C=40A,$ $R_{Gon}=36\Omega, V_{GE}=\pm 15V,$ $di/dt=385A/\mu s(T_J=150^{\circ}C),$ Inductive Load	$T_J=25^{\circ}C$		3.7		mJ
		$T_J=125^{\circ}C$		4.1			
		$T_J=150^{\circ}C$		4.3			



E _{off}	Turn-off Switching Loss	V _{CC} =600V, I _C =40A, R _{Goff} =36Ω, V _{GE} =±15V, du/dt=3855V/μs(T _J =150°C), Inductive Load	T _J =25°C		2.3		mJ
			T _J =125°C		2.5		
			T _J =150°C		2.9		
Q _g	Total Gate Charge	V _{GE} =-15V...+15V	T _J =25°C		457		nC
R _{G(int)}	Internal Gate Resistor		T _J =25°C		0		Ω
I _{SC}	V _{CC} =600V, V _{GE} =±15V, t _p =10us, T _J =150°C				162		A
R _{θJC}	Thermal Resistance: Junction-to-Case (per IGBT)					0.52	°C/W

FWD, Inverter

Maximum Rated Values (T_C=25°C unless otherwise specified)

Symbol	Description	Conditions	Values	Units
V _{RRM}	Repetitive Peak Reverse Voltage	T _J =25°C	1200	V
I _F	Diode Continuous Forward Current		40	A
I _{FM}	Peak FWD Current Repetitive	t _p =1ms	80	A

Electrical Characteristics of Diode (T_C=25°C unless otherwise specified)

Symbol	Description	Conditions		Min.	Typ.	Max.	Units
V _{FM}	Forward Voltage	I _F =40A	T _J =25℃		1.70		V
			T _J =125℃		1.85		
			T _J =150℃		1.85		
I _{rr}	Peak Reverse Recovery Current	I _F =40A, di/dt=432A/μs(T _J =150℃), V _{rr} =600V, V _{GE} =-15V	T _J =25℃		24.3		A
			T _J =125℃		25.4		
			T _J =150℃		25.8		
t _{rr}	Reverse Recovery Time		T _J =25℃		174		ns
			T _J =125℃		190		
			T _J =150℃		208		
Q _{rr}	Reverse Recovery Charge		T _J =25℃		2.2		μC
			T _J =125℃		2.4		
			T _J =150℃		2.8		



E _{rec}	Reverse Recovery Energy	I _F =40A, di/dt=432A/μs(T _J =150°C), V _{rr} =600V, V _{GE} =-15V	T _J =25°C		0.17		mJ
			T _J =125°C		0.18		
			T _J =150°C		0.20		
R _{θJC}	Thermal Resistance: Junction-to-Case (per Diode)					0.82	°C/W

IGBT, Brake-Chopper

Maximum Rated Values (T_C=25°C unless otherwise specified)

V _{CES}	Collector-Emitter Blocking Voltage		1200	V
V _{GES}	Gate-Emitter Voltage		±20	V
I _C	Continuous Collector Current	T _C =100°C	25	A
		T _C =25°C	50	A
I _{CM}	Repetitive Peak Collector Current	t _p =1ms	50	A
P _D	Maximum Power Dissipation per IGBT	T _C =25°C T _{Jmax} =175°C	224	W

Electrical Characteristics of IGBT (T_C=25°C unless otherwise specified)

Static Characteristics

Symbol	Description	Conditions		Min.	Typ.	Max.	Units
V _{GE(th)}	Gate-Emitter Threshold Voltage	I _C =1mA, V _{CE} =V _{GE}		5.0	5.6	6.5	V
V _{CE(sat)}	Collector-Emitter Saturation Voltage	I _C =25A, V _{GE} =15V	T _J =25°C		1.75	2.10	V
			T _J =125°C		2.10		
			T _J =150°C		2.20		
I _{CES}	Collector-Emitter Leakage Current	V _{GE} =0V, V _{CE} =V _{CES} , T _J =25°C				1	mA
I _{GES}	Gate-Emitter Leakage Current	V _{GE} =±20V, V _{CE} =0V, T _J =25°C				200	nA
C _{ies}	Input Capacitance	V _{CE} =25V, V _{GE} =0V, f=100kHz			1.64		nF
C _{oes}	Output Capacitance				0.44		
C _{res}	Reverse Transfer Capacitance				0.02		



Switching Characteristics

t _{d(on)}	Turn-on Delay Time	V _{CC} =600V, I _C =25A, R _{Gon} =20Ω, V _{GE} =±15V, Inductive Load	T _J =25℃		57		ns	
			T _J =125℃		58			
			T _J =150℃		68			
t _r	Rise Time		T _J =25℃		55		ns	
			T _J =125℃		58			
			T _J =150℃		60			
t _{d(off)}	Turn-off Delay Time		V _{CC} =600V, I _C =25A, R _{Goff} =20Ω, V _{GE} =±15V, Inductive Load	T _J =25℃		208		ns
				T _J =125℃		211		
				T _J =150℃		214		
t _f	Fall Time	T _J =25℃			76		ns	
		T _J =125℃			223			
		T _J =150℃			225			
E _{on}	Turn-on Switching Loss	T _J =25℃			3.1		mJ	
		T _J =125℃			3.8			
		T _J =150℃			4.1			
E _{off}	Turn-off Switching Loss	V _{CC} =600V, I _C =25A, R _{Goff} =20Ω, V _{GE} =±15V, du/dt=4543V/μs (T _J =150℃) Inductive Load	T _J =25℃		2.1		mJ	
		T _J =125℃		2.4				
		T _J =150℃		2.5				
Q _g	Total Gate Charge	V _{GE} =+15V...-15V	T _J =25℃		400		nC	
R _{G(int)}	Internal Gate Resistor		T _J =25℃		0		Ω	
I _{SC}	V _{CC} =600V, V _{GE} =+/-15V, T _J =25℃				100		A	
R _{θJC}	Thermal Resistance: Junction-to-Case (per IGBT)					0.66	℃/W	

Diode, Brake-Chopper

Maximum Rated Values ($T_C=25^\circ C$ unless otherwise specified)

Symbol	Description	Conditions	Values	Units
V_{RRM}	Repetitive Peak Reverse Voltage	$T_J=25^\circ C$	1200	V
I_F	Diode Continuous Forward Current		10	A
I_{FM}	Repetitive Peak Forward Current	$t_p=1ms$	20	A



Electrical Characteristics of Diode ($T_C=25^\circ\text{C}$ unless otherwise specified)

Symbol	Description	Conditions		Min.	Typ.	Max.	Units
V _{FM}	Forward Voltage	I _F =10A	T _J =25°C		1.70		V
			T _J =125°C		1.80		
			T _J =150°C		1.75		
t _{rr}	Reverse Recovery Time	I _F =10A, -diF/dt=159A/μs(T _J =150°C), V _{rr} =600V, V _{GE} =-15V	T _J =25°C		195		ns
			T _J =125°C		231		
			T _J =150°C		241		
I _{rr}	Peak Reverse Recovery Current		T _J =25°C		6.0		A
			T _J =125°C		7.6		
			T _J =150°C		7.9		
Q _{rr}	Reverse Recovery Charge		T _J =25°C		0.6		μC
			T _J =125°C		0.7		
			T _J =150°C		0.8		
E _{rec}	Reverse Recovery Energy	T _J =25°C		0.2		mJ	
		T _J =125°C		0.4			
		T _J =150°C		0.5			
R _{θJC}	Diode Thermal Resistance: Junction-to-Case(per Diode)					2.02	°C/W

Diode, Rectifier

Maximum Rated Values ($T_C=25^\circ\text{C}$ unless otherwise specified)

V_{RRM}	Repetitive Peak Reverse Voltage	$T_J=25^\circ\text{C}$	1800	V
I_{FRMSM}	Maximum RMS Forward Current per Chip	$T_C=80^\circ\text{C}$	30	A
I_{RMSM}	Maximum RMS Current at Rectifier Output	$T_C=80^\circ\text{C}$	45	A
I_{FSM}	Surge Current @ $t_p=10\text{ms}$	$T_J=25^\circ\text{C}$	380	A
		$T_J=150^\circ\text{C}$	315	
I^2t	I^2t - value	$T_J=25^\circ\text{C}$	720	A^2s
		$T_J=150^\circ\text{C}$	495	



Electrical Characteristics of Diode (T_C=25°C unless otherwise specified)

Symbol	Description	Conditions		Min.	Typ.	Max.	Units
V _F	Forward Voltage	I _F =40A	T _J =25°C		1.25		V
			T _J =150°C		1.25		
I _R	Reverse Current	V _R =1600V	T _J =25°C			1	mA
R _{θJC}	Thermal Resistance: Junction-to-Case (per Diode)					0.86	°C/W

Internal NTC-Thermistor Characteristics

Symbol	Conditions	Min.	Typ.	Max.	Units
R ₂₅	T _C =25°C		5		kΩ
ΔR/R	T _C =100°C, R ₁₀₀ =465Ω	-5		+5	%
P ₂₅	T _C =25°C			10	mW
B _{25/50}	$R_2 = R_{25} \exp[B_{25/50}(1/T_2 - 1/(298.15K))]$		3380		K
B _{25/80}	$R_2 = R_{25} \exp[B_{25/80}(1/T_2 - 1/(298.15K))]$		3440		K
B _{25/100}	$R_2 = R_{25} \exp[B_{25/100}(1/T_2 - 1/(298.15K))]$		3545		K

Module

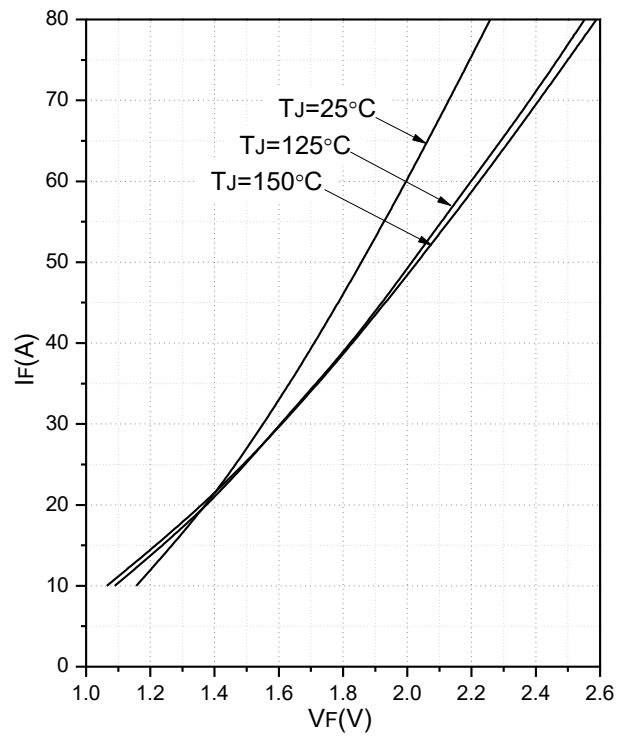
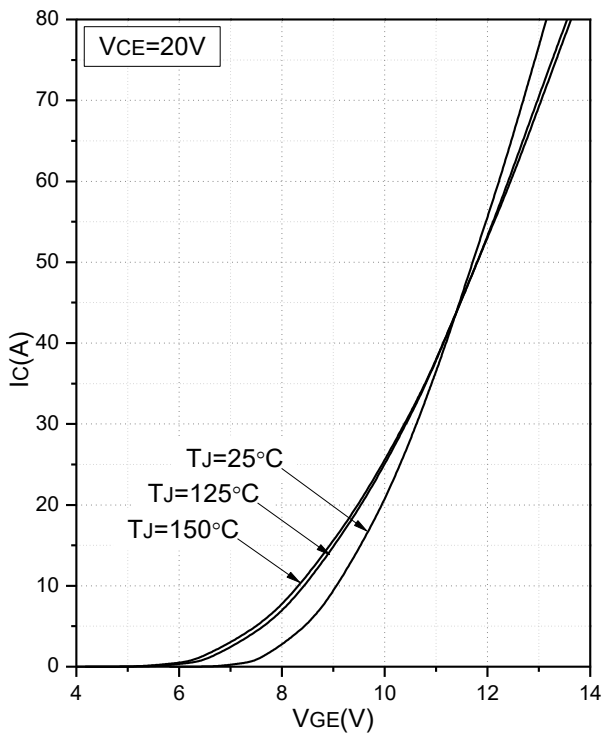
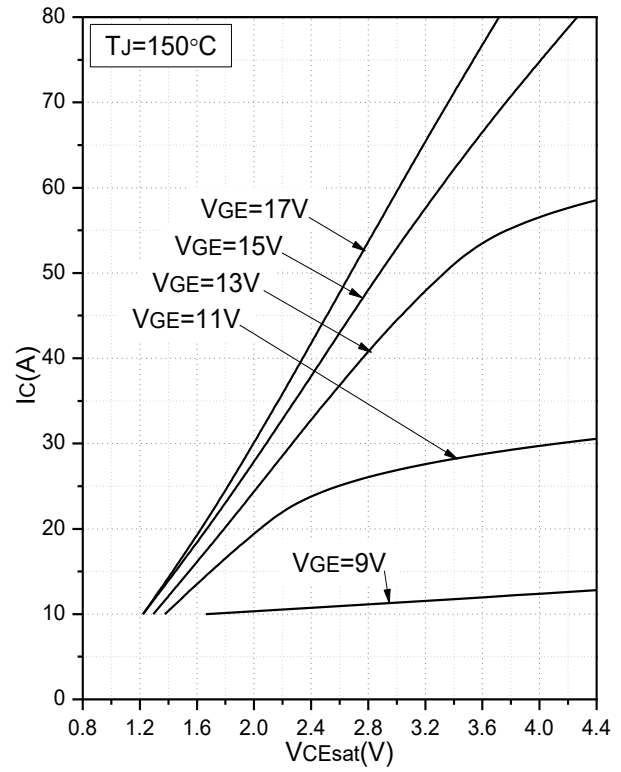
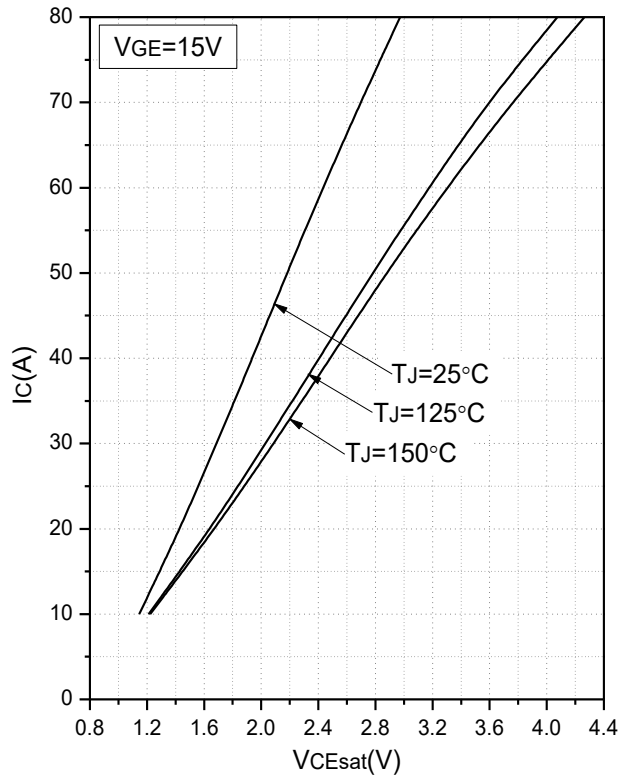
Symbol	Description		Min.	Typ.	Max.	Units
V _{iso}	Isolation Voltage (All Terminals Shorted)	f=50Hz, 60s	2500			V
T _J	Maximum Junction Temperature				175	°C
T _{JOP}	Maximum Operating Junction Temperature Range		-40		+150	°C
T _{stg}	Storage Temperature		-40		+125	°C
CTI	Comparative Tracking Index		225			
R _{θCS}	Case-To-Sink Thermally (Conductive Grease Applied)				0.05	°C/W
T	Mounting Screw:M4		1.5		2.0	N·m
G	Weight			31		g



Ordering Information Table

Device code	G	T	40	PI	120	C7	H
	①	②	③	④	⑤	⑥	⑦

- ① - IGBT Module
- ② - Trench & Field Stop IGBT
- ③ - Rated Current (40=40A)
- ④ - Circuit Configuration (Power Integrated)
- ⑤ - Rated Voltage (120=1200V)
- ⑥ - Package Type
- ⑦ - Test Level (Pass the Important Reliability Test-Industrial Grade)



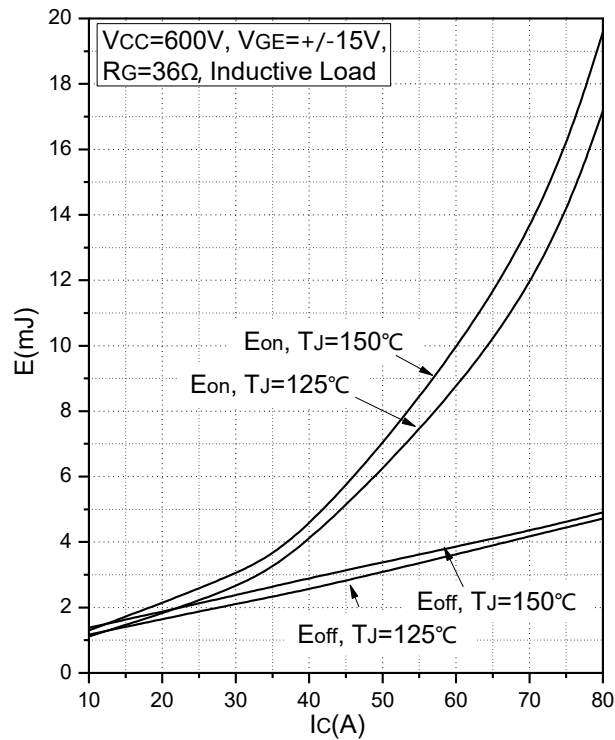


Fig.5 Typical Switching Loss vs. Collector Current (Inverter)

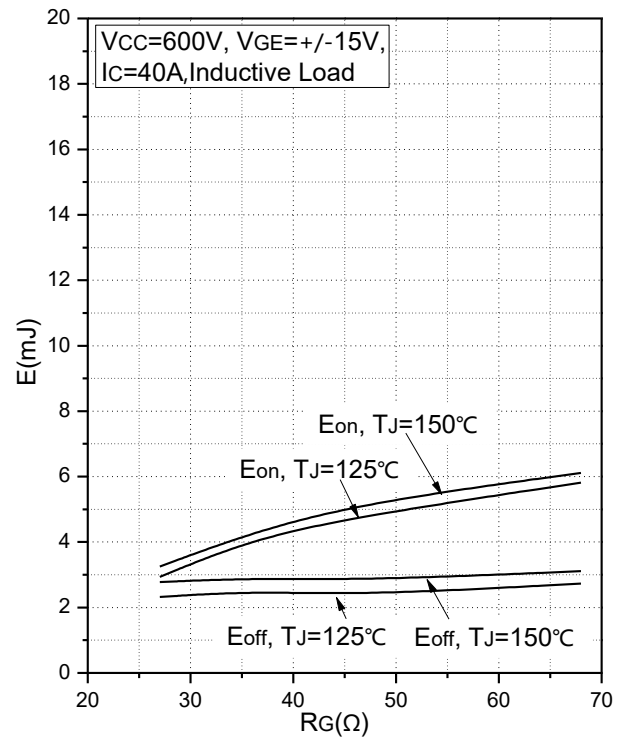


Fig.6 Typical Switching Loss vs. Gate Resistance (Inverter)

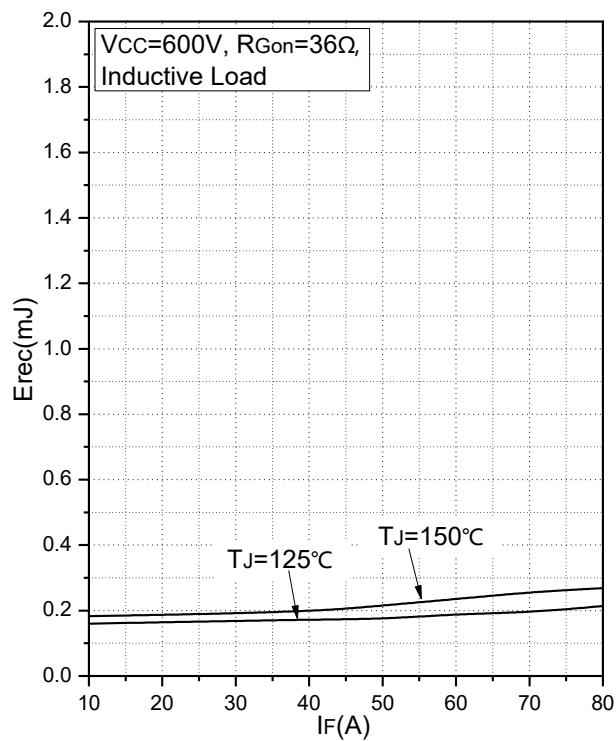


Fig.7 Typical Switching Loss vs. Forward Current (Inverter)

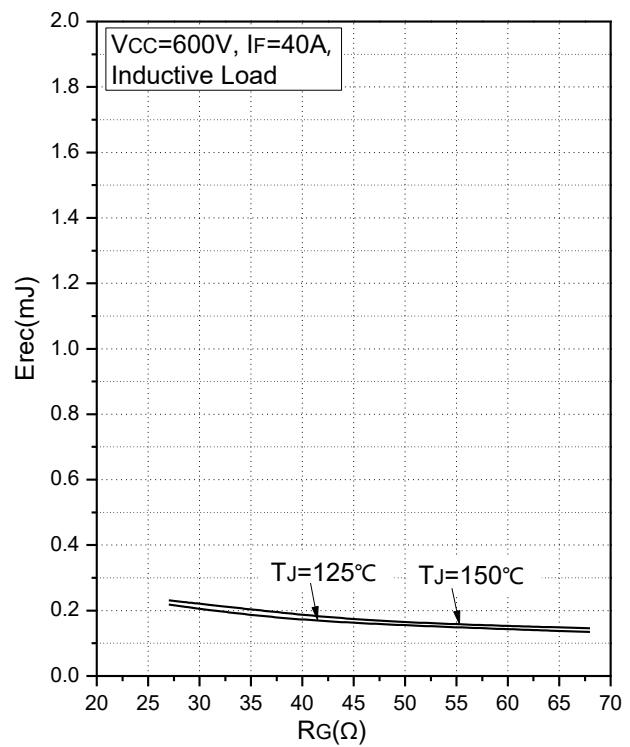
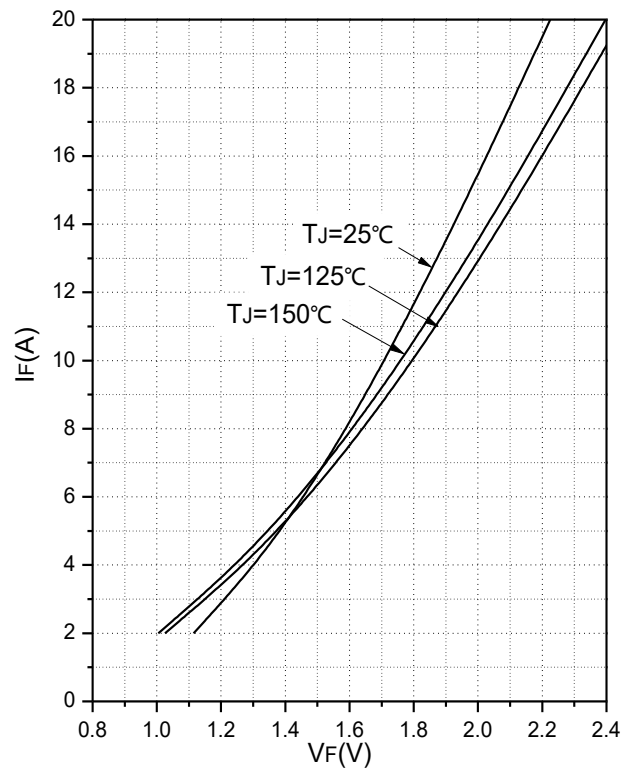
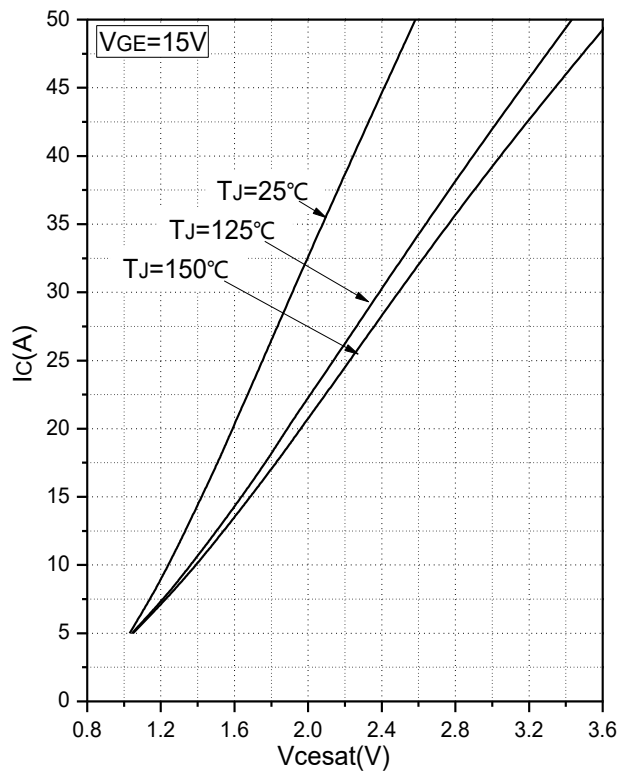
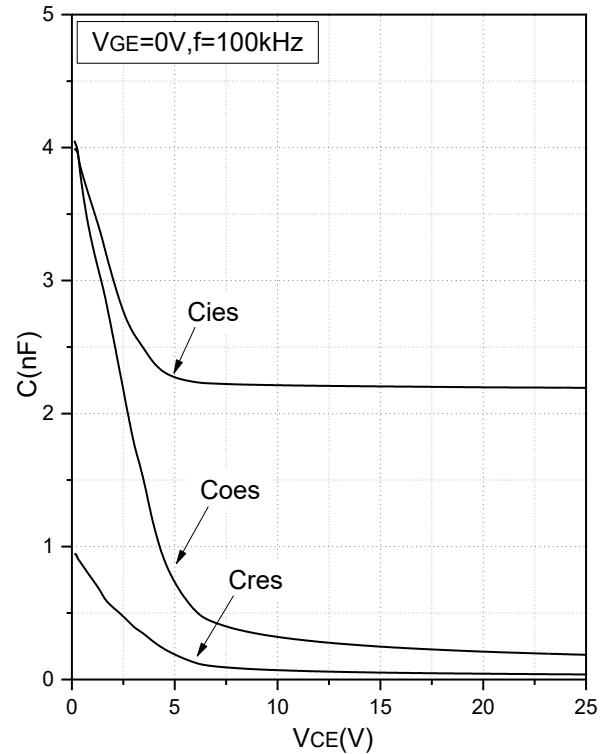
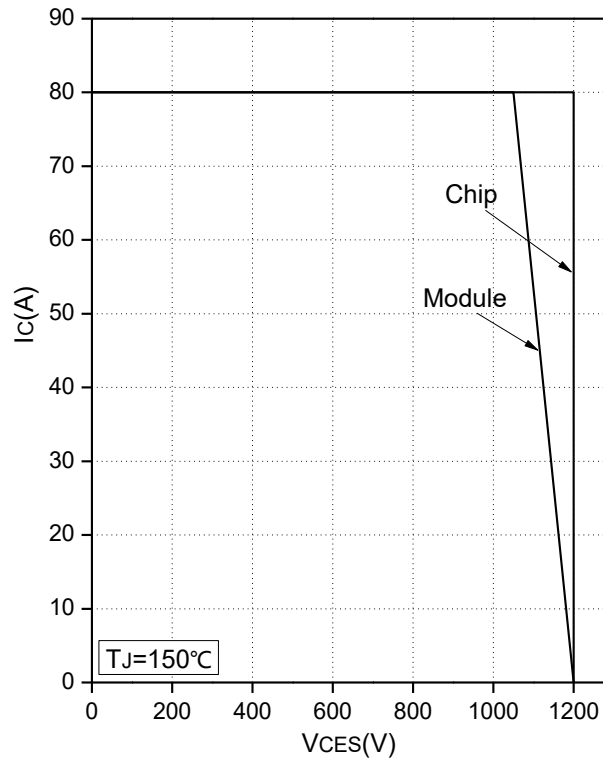


Fig.8 Typical Switching Loss vs. Gate Resistance (Inverter)



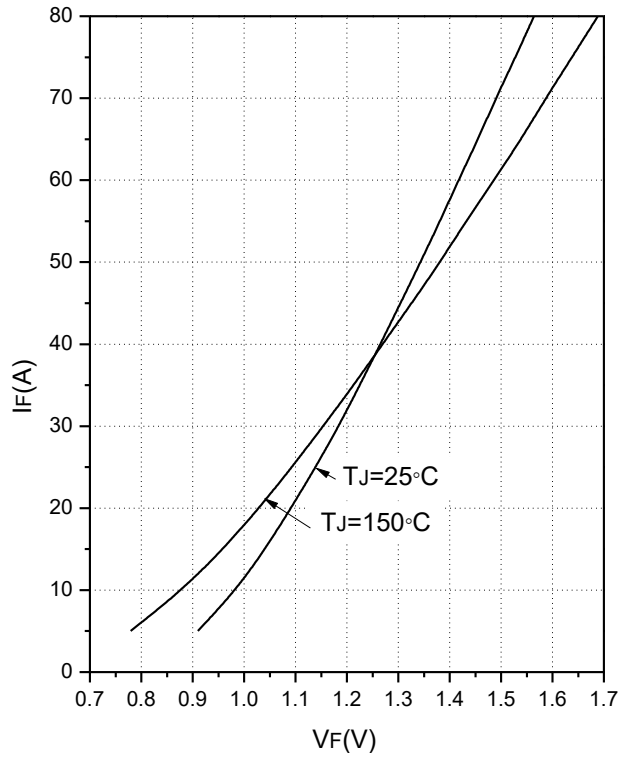


Fig.13 Forward Characteristics of Diode (Rectifier)

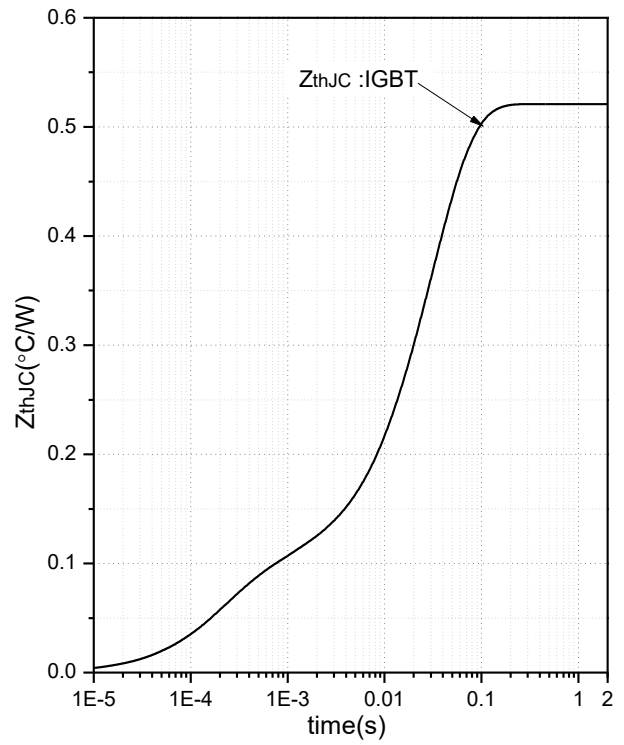


Fig.14 Transient Thermal Impedance (Inverter-IGBT)

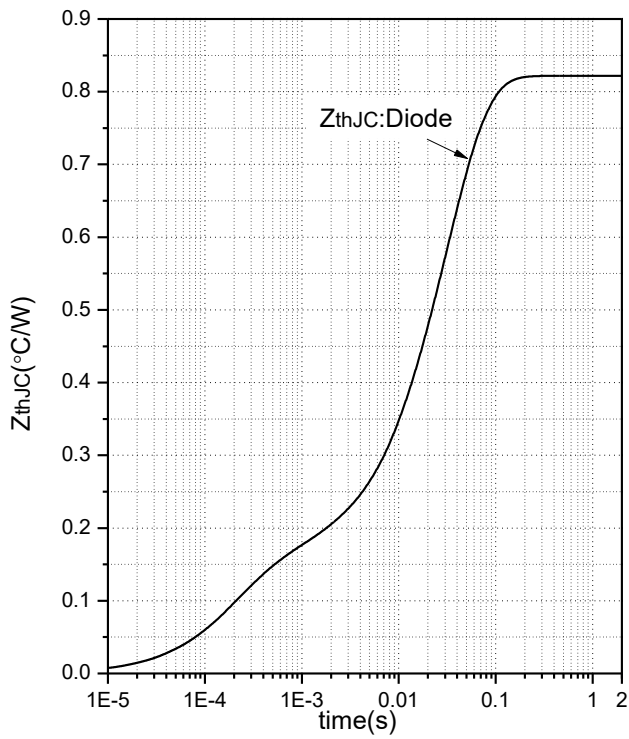


Fig.15 Transient Thermal Impedance (Inverter-FWD)

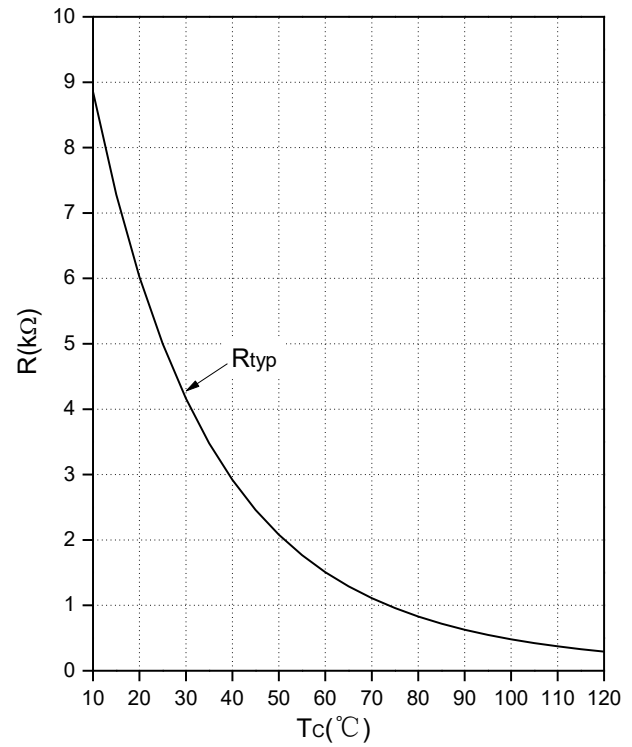
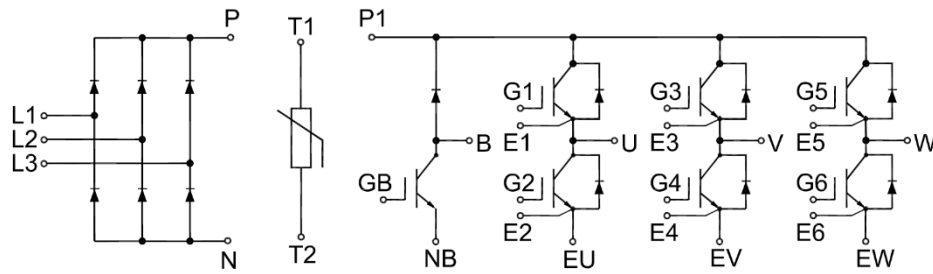


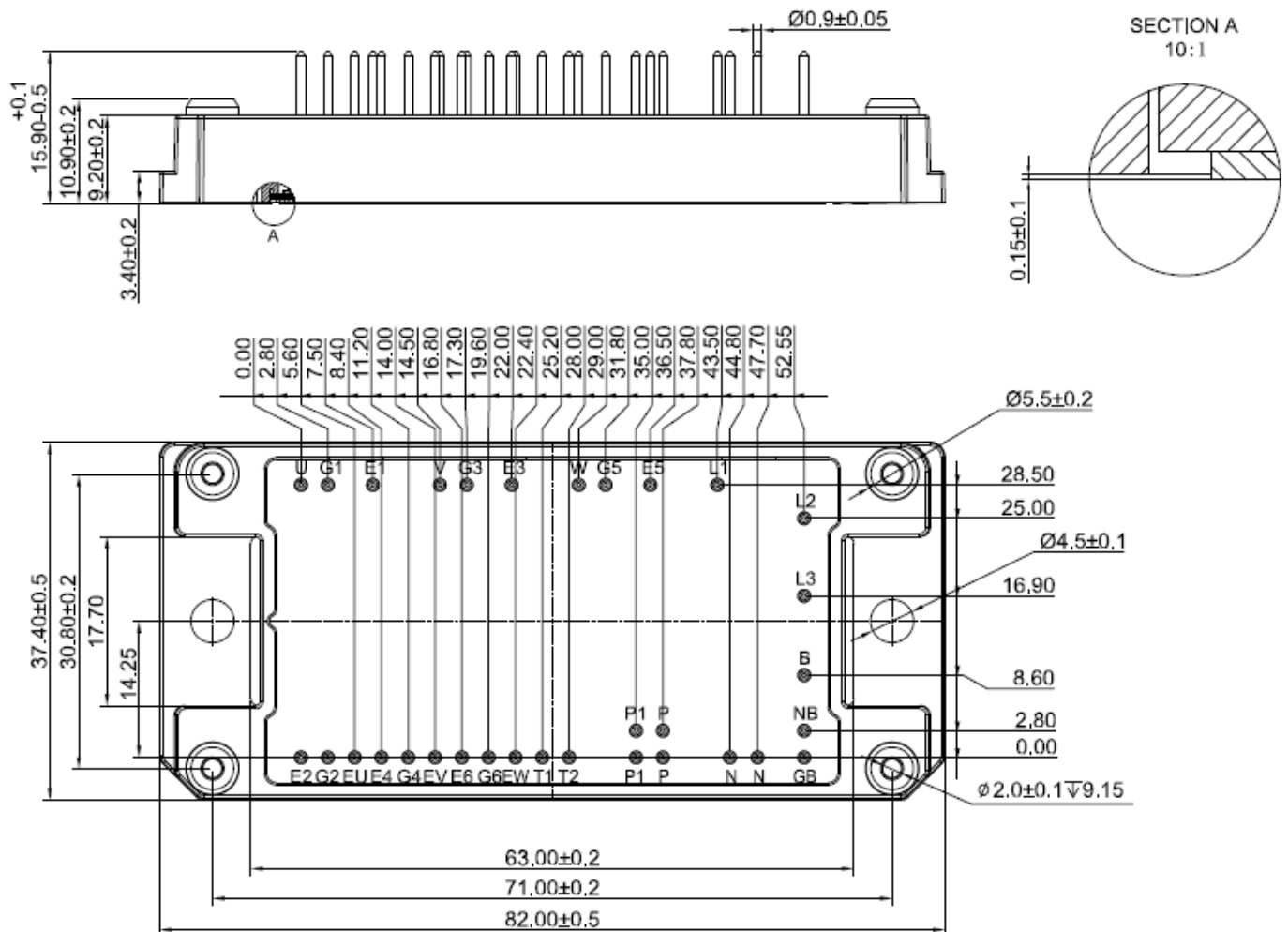
Fig.16 NTC Temperature Characteristics



Internal Circuit



Package Outline (Unit: mm):





Revision	Notes
01	Initial Release

Announcement

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The released datasheet would be issued with “REV.” + “alphabet characters”.